ANALYTICAL AND BIBLIOGRAPHICAL NOTICES.

Art. XX.—*Hand-book of Medical Microscopy.* By Joseph G. Richardson, M. D., Microscopist to the Pennsylvania Hospital; Secretary of the Biological and Microscopical Section of the Academy of Natural Sciences, etc. etc. etc. 12mo. pp. 333. Philadelphia: J. B. Lippincott & Co., 1871.

In this "hand-book" the author treats, first, of the microscope, its instruments, apparatus, and manipulations; and, secondly, of the employment of that instrument in pathological observations. He tells us in the preface that it was written to "fully elucidate all those minute but important details which, because they seem so simple to the skilful observer, have generally been passed over without particular explanation. Especial attention has also been paid to pointing out the mistakes into which an inexperienced microscopist is liable to fall from errors of observation or deduction." How successful Dr. Richardson has been in this task it becomes our duty to inquire.

We shall notice the optical parts of the volume first, and then pass on to a consideration of those chapters treating more especially of the use of the instrument in clinical medicine. The author explains, briefly, the optical principles of the simple microscope, which, we believe, is not now employed in pathology, and which we are informed has been superseded by the compound instrument; but we fail to find any description of the principles of the compound microscope, which *is* used in anatomical research.

Several forms of the compound instrument, however, are figured, and their mechanical arrangements described. The cheaper forms of microscope, which the author recommends for the beginner, are supplied with French objectives, and where these magnify from 250 to 600, and are non-adjusting for thickness of glass cover, our experience, and that of most others who have worked with such lenses, have taught us they are worthless for all accurate observation. Even the second quality lenses of our own makers are known by all judges to be much superior to these low-priced, commercial French objectives.

If Dr. Richardson has aimed at giving the beginner information regarding our own makers of good and moderately low-priced instruments, he has been, perhaps, unintentionally forgetful of some distinguished manufacturers in New York.

In noticing, on page 25, the optical construction of our best high-power objectives, our author falls into an error, from which even a moderate acquaintance with the subject would have saved him. He tells us such lenses are composed of "three pairs of lenses, each pair a doublet." Now, all authors who have written on this subject—and we mention only Carpenter and Hogg, because their works are in the hands of all—state that the objectives alluded to by our author "consist of as many as eight distinct lenses, the front and back being *triplet* combinations, with a doublet between." These authors also tell us that even the $\frac{1}{2}$, $\frac{4}{10}$, and $\frac{1}{4}$ inch objectives are made in the same way. Even the 1 inch and $\frac{2}{3}$ have a triplet combination in the posterior lens, while the anterior only is a doublet.

Again, the author informs us on page 29 that "most eye-pieces are composed of two achromatic lenses," in which statement he goes far beyond the knowledge of makers or authors who are most familiar with the subject. The Huyghenian eye-piece, made of two plano-convex lenses, neither achromatic, is the form in use in all our microscopes. We can explain an error like this only by the fact that very many persons work with instruments year after year without thinking or caring how they are constructed; but such persons never become skilful in manipulation, nor qualified to instruct others in that which they do not understand themselves.

In writing of the binocular microscope—an instrument which American physicians and microscopists are singularly uninformed about—Dr. Richardson betrays the usual unacquaintance with its construction. He says the effect is obtained by an arrangement of "prisms," placed just above the objective. By reference to any recent work on the microscope, or inquiry of those using the binocular instrument, the author would have learned that Mr. Wenham employs only *one* prism for binocular effect, and his form is the only one in use by all English and a few American physicians.

In his explanation of the means employed to obtain polarized light, the author is equally unfortunate. He tells us, "two crystals of Iceland spar" are used in the microscope for this purpose. Doubtful, indeed, would be the results thus obtained. Since Erasmus Bartholin first discovered the phenomenon of double refraction in Iceland spar, we have no record in the books of that substance having been employed in its natural form of crystallization to obtain polarization in the microscope. But Mr. Nicol succeeded in cutting the natural prism into two equal portions, by a section carried through the "acute lateral angle, and nearly touching the obtuse solid angle." These sections are then highly polished, and cemented together with Canada balsam, and in its new arrangement the Nicol prism transmits "only *one* of the two rays, into which an ordinary beam of light is made to divaricate by passing through that substance." Mr. Nicol's process is published in the *Edinburgh Philosophical Journal*, vol. vi., p. 83. Dr. Richardson thinks, moreover, polarized light "possesses no great practical value." In geology alone, such men as Allport, Sorby, David Forbes, and others find polarized light the only means of surely detecting, in some doubtful cases, the presence of the igneous or crystalline rocks. The vegetable histologist also well knows he has no surer means of detecting starch granules; and the application of polarized light by such men as Professor Boeck of Christiania—who was the first to apply this means of investigation to animal tissues—and Brücke, promises an extension of our knowledge in regard to the obscure nature of the sarcous elements of muscular fibre. Polarized light, when skilfully employed, reveals to the ophthalmic surgeon earlier changes in the density of the crystalline lens in man and the lower animals, than can be detected by other means. And in the diagnosis of diabetic urine we have no surer test than polarized light.

Our author gives directions in Chapter II. for dry-mounting. "The object—an itch insect, for example—is simply to be deposited on an ordinary glass slide, in a suitable position, a thin glass cover laid gently upon it, and a piece of colored glazed paper, perforated by a circular opening, and coated on its under side with mucilage, pressed down over it," etc. We might be surprised that directions like these should still be found in the books, did we not know from ample experience in this department of microscopical work, that carelessness and the crudest results are the rule, rather than the exception. Are we never to make progress in the important attempt to properly prepare and preserve microscopical specimens in a condition fit for scientific study? We do not despair, even, when these old myths are found perpetuated in modern books. An acarus, or other delicate organization, so put up, would be crushed out of all shape; and it is common experience with all *who have worked* in this line to find that fungi soon invade and destroy the victims of such work; neither can they be best displayed, even temporarily, in that manner.

All through this portion of his book the author presupposes much knowledge on the part of the beginner, and, although the camera lucida and steel disk of Sœmmering are recommended for drawing, yet nowhere in the volume are those accessories described. We regret that the author has not treated the subject matter of the first two chapters of this hand-book more fully and lucidly, and must confess that they do not realize our expectations, especially as they are written by one who occupies the honourable position of "Secretary of the Biological and Microscopical Section of the Academy of Natural Sciences." Doubtless, microscopical science in our city will admit of improvement; but we cannot think that this work affords a fair representation of its condition.

Dr. Richardson is manifestly not acquainted with the elementary optical principles of construction of either our best high power objectives, or of our common eye-pieces; and it is, therefore, necessary to accept with cautious allowance, or with positive distrust, what he may say about the superior quality of the optical arrangements employed by himself.

In selecting the salivary corpuscle as the most accessible and best object for the beginner to practise upon in his microscopical manipulation, we are happy to say that the author has taken a step in advance of those writers who direct that a fibre of linen or cotton cloth, or a crumb of bread, should be chosen for that purpose. These last-named articles have no direct relation to human histological observation, while salivary corpuscles and epithelial cells must be identified by the would-be pathologist, and the directions given by the author for their examination, are very full and clear, and must be of value to beginners.

Five chapters are devoted to the examination of the urine. The appearances which may be detected in that liquid by the unassisted eye, are made the basis of classification: as, for example, light, and flocculent deposits; other flocculent deposits; dense and bulky deposits; scanty and granular or crystalline deposits, and substances which float in or upon that liquid. But as these chapters are mainly commentaries on the works of Beale, Golding Bird, and Roberts, which have taken their place in medical literature, we shall allude to them in order to make only this remark. Our author directs on page 68, that the urine be allowed to stand, after collection, "twelve hours," before examination. In allowing twelve hours, Dr. Richardson differs widely from other authors. Drs. Roberts and Beale direct that the urine should be examined within a few hours after its secretion, because some specimens of that liquid "pass into decomposition within a very short time after they have escaped from the bladder." Blood cells change quickly in alkaline urine, and vibriones and bacteria sometimes swarm in such urine, in a short time after it has been secreted. "In those cases in which uric acid or octahedral crystals of oxalate of lime are present, the deposit increases in quantity after the urine has stood for some time. These salts are frequently not to be discovered in urine immediately after it is passed, but make their appearance after a few hours."

Even that amœboid motion, which seems to have been such a glorious revelation to our author when seen under his $\frac{1}{25}$, we are are told on page 85, may be observed in the white blood corpuscles in the urine of cystitis "if examined while fresh." Again, on page 134, Dr. Richardson admits "the clinical importance of a sediment of uric acid occurring in urine after twelve hours' standing, is very slight," and doubtless he is correct in this admission.

Our author devotes Chapter VIII. to the examination of saliva, mucus, pus, and milk; and the beginner finds himself, at once, plunged into the conflicting theories regarding the identity, or otherwise, of the salivary, mucous, pus, and white blood corpuscles. The author diluted a drop of his own blood on a slide under the microscope, with pure water; and he "found it quite possible to watch every step of the change in which, by *mere distension*, the white blood cell is converted into the salivary corpuscle, with its one, two, or three nuclei; its actively revolving molecules confined by a cell-wall of exceeding tenuity." Also, "when the liquor muci and liquor puris are similarly diluted, their corpuscles are also seen, for the most part, to be converted into salivary globules;" and the author "concludes, *therefore*, that most of the corpuscles of human pus are simply white blood-cells, which have wandered out through the vascular walls." Now, whether this idea of the identity of the Leucocytes of Robin shall be accepted or not, will depend upon the character of the evidence advanced in its favour; and while such doctrine is highly probable, we think the amount of proof in its favour is yet inadequate to justify its full acceptance. Moreover, the mere similarity *in appearance*, observed by our author, in these corpuscles, when under dilution by water, we deem entirely insufficient to warrant the conclusion that they are really alike in nature. The experienced embryologist well knows he cannot distinguish by mere microscopic inspection, the essential distinctions between many cells which resemble each other in structure, but develop finally into organizations widely dissimilar. We are told, moreover, in *Stricker's Human and Comparative Histology*, vol. i. p. 13, that the "dancing movement ceases in the interior of the corpuscles of saliva, on the cautious addition of a solution of common salt, from one-half to one per cent. in strength, but this still permits the movement in fresh pus or lymph corpuscles to continue." We think the beginner would have found clearer directions for the identification of these important elements of pathological observations, had there been less theoretical doctrine mixed up with the admitted characters belonging to these corpuscles. And in writing hand-books for young students in the obscure departments of the medical art, it would be more desirable to present only the *established facts* of the science, than to become the prophet of doubtful things, at present only foreshadowed.

In treating of the examination of the blood, our author adopts the theory, older than the time of Schwann, that the red corpuscles are little bags filled with a coloured fluid; because this hypothesis explains better than any other the phenomena they exhibit.

The evidence brought forward in support of this view, we observe, is derived chiefly from observations on the dried blood of the Menobranchus; in which each dried corpuscle has its cell-wall apparently "propped out" by crystals formed within the cell. These intra-cellular crystals, Dr. Richardson figures in a very interesting paper on the subject, published in the *Transactions of the American Medical Association* for 1870. Now, while the appearances described by our author as being present in post-mortem blood corpuscles that have undergone coagulation with the fibrin in which they were enveloped on the glass slide, may have been apparent under the microscope; yet, it is by no means proved that those appearances are not susceptible of a very different interpretation.

The unsettled state of our knowledge respecting the red corpuscles of the blood is really remarkable, considering that physiologists have been examining into their structure ever since Swammerdam clearly detected their presence in the frog in 1658; and Leeuwenhoek in man, so far back as 1673, and it is more than probable they were known much earlier. The best observers of modern times, with rare exceptions, deny the existence of a cell-wall—that is, of a limiting membrane, structurally and chemically dissimilar from the other portions of the corpuscle. The German school of histologists teach the opposite doctrine; and Stricker and Alexander Rollett[1] do not assert the existence of a cell-wall. Robin, of France, and Dalton, and Flint, also deny its presence, though Draper writes of these corpuscles as "little elastic sacks." Dr. Beale is very clear in denying the existence of a cell-wall to the blood disks. We shall quote a paragraph from Dr. Beale, because he is quite familiar with the employment of high powers in this line of observation. "The red blood corpuscle of man and mammalia generally consists of a mass of soft viscid matter, perhaps of the consistence of treacle, composed of hæmatocrystallin. The outer part of this matter is of firmer consistence than the interior, especially in the older corpuscles. When the latter are placed in water, the more soluble matter is dissolved, leaving the harder external portion. By the action of many chemical agents, the outer part of the red blood corpuscle is condensed. These and other appearances have led observers generally to the conclusion that the red blood corpuscle was a cell containing fluid contents; and so firm has been the conviction that this is so, that the rupture of the 'cell,' and the escape of the contents, have been spoken of as if they had actually occurred, and had been seen. That the red blood corpuscle is not a cell, is proved conclusively by the following facts:—

"1st. A red blood corpuscle may be divided into many smaller portions, every one of which assumes the spherical or spheroidal form, and in many cases becomes stellate.

"2d. The mass of germinal matter, in the case of the nucleated blood corpuscle of the frog, or a portion of it, may pass right through the red viscid material of which the outer part of the corpuscle is composed, without the rupture of any membrane, just as a solid particle might pass through treacle or molten pitch.

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[1] Human and Comparative Histology.

"3d. A red blood corpuscle from guinea pigs' blood assumes the crystalline form very readily, and without the addition of any reagent. The process may be watched under the microscope, and a single corpuscle seen to become a single crystal.

"4th. Several red blood corpuscles, under certain circumstances, run together, forming a soft homogeneous viscid mass; in which nothing like cell-walls, or the remains of such structures can be seen, and which undergoes crystallization in every part without exhibiting indications of cell-walls anywhere.

"5th. When water is added to blood corpuscles, they swell up just as a piece of jelly would swell up; but they do not burst, as is generally stated. No doubt soluble matters are dissolved out, but as the water evaporates, the corpuscles assume their previous form, although they appear paler than before. Although many appearances may be urged in favour of the existence of a cell-wall, the above facts, and those learned from studying the changes taking place during the development of the corpuscle, seem to be absolutely incompatible with such a view. Neither here nor elsewhere is the 'cell-wall' a necessary or essential portion of the elementary part. A thing may arise from a thing which existed before it; grow, live, perform its offices, and increase its kind without having a cell-wall at any period of its existence; and cell-walls may be easily made artificially, so that in spite of the importance hitherto attached to it, the 'cell-wall' is of no real significance."

That Dr. Richardson should have misinterpreted the appearances seen under his microscope is not so remarkable, since his Hand-book shows too plainly that he has not yet acquired a practical knowledge of his lenses, nor uncommon expertness in illumination or manipulation; and it must be regretted that the beginner should be misled by views based upon misinterpretations of appearances which are explainable in another manner, especially when taught by one who writes to "point out the mistakes into which an inexperienced microscopist is liable to fall from errors of observation or deduction."

In estimating the average number of white blood corpuscles in any given specimen of blood, our author truly says a "definite standard must be obtained," and he recommends to count the number to be found in five or ten "fields" of the microscope.

This is about as definite as it would be to attempt to measure the height of a man with a piece of tape. Persons really familiar with the microscope are aware that the size of the "field"—using the term in the sense intended by the author—depends upon the construction of the eye-piece, which our author seems not to understand, and the area of the field differs widely in instruments of different makers. The English and American microscopes have larger fields than those made in Europe, with few exceptions, and a specimen of blood, therefore, presenting only six white corpuscles when seen in an instrument having a small field, might show twice as many under a field with a wider area, and all comparative estimates, therefore, made by this plan, must be quite arbitrary, or entirely fallacious.

The remaining chapters of the book treating of sputum—vomited matters—discharges from mucous surfaces—parasites—the medico-legal examination of blood-stains, etc.—and morbid growths—may be consulted by the beginner with more advantage, because the author has combined the labours of others with his own experience, mainly free from theoretical views, and this is of great importance for those readers who are unpractised in difficult departments of microscopical research.

The superiority claimed by the author for his $\frac{1}{25}$ and $\frac{1}{50}$ we cannot think is made good in the book, for not one observation is there recorded but may be verified by lenses of longer focal length, and costing less money. The definition obtained by using lenses of such short focus, is "eminently delusive," and although they enable us to glimpse the dancing motion in a salivary corpuscle, yet if *observed accurately* each dancing granule is always surrounded with an "unhappy luminosity" about its margin, which is unavoidable, because these lenses contain errors of spherical aberration, which forbid *perfect* definition. Histologists are resting satisfied with an *approximation* to distinctness of definition in their lenses, and this fact becomes apparent on the employment of deep eye-pieces, or of the achromatic amplifier; and it is improbable that there is one lens in America, at the present time, that will clearly define a Bacterium. though they may reveal lines on the diatoms more numerous than the eye can count. But a change is promised in this direction. Mr. Oscar Knipe, of this city, first proposed, in 1856, the use of negative achromatic lenses properly adjusted in the tube of the microscope, as a means of obtaining power with lenses of moderate focal length, and the plan has been in use until the present time, the obstacle to its extension being the imperfect correction of most objectives. By this means we are able to examine objects in shallow cells through moderately thick glass covers, and with a power and definition not to be obtained in any other known way. And since Dr. Royston-Piggott is calling the attention of opticians to these facts, in his various communications to the Royal Microscopical Society, and Mr. E. A. Dickerson, of New York, in a paper published in the October number of the *Science Gossip* for 1870, is also working in the same line, we feel hopeful that such an improvement will be made in lenses that any desirable power may be thus obtained, without the necessity of employing objectives of *extreme* shortness of focal length.

In his examination of sputum Dr. Richardson is the first to call attention to the square fracture exhibited by the elastic fibres of the expectorated pulmonary air-cells, and doubtless it is a diagnostic character of great value.

The volume is illustrated with thirty figures, ten of which are original; and has an index full enough for all purposes of reference and study.

We leave unnoticed a few literary errors, such as the grouping in one ponderous paragraph irrelevant matters, and—as we deem it—some defects in the arrangement of the subject. Indeed, extreme haste in preparation is manifested in its pages, and we therefore regard the book as one of those melancholy cases of premature delivery not altogether unknown to medical experience.

J. G. H.

ART. XXI.—*Microscopical Anatomy of the Human Liver.* By H. D. SCHMIDT, M.D., of New Orleans. 8vo. pp. 59.

THIS excellent paper on the minute anatomy of the liver, by Dr. H. D. Schmidt, formerly of this city, now of New Orleans, was originally published in the *Journal of Medicine* of the latter place, for October, 1869, and has now been issued as a separate publication. The author's researches are elaborate, and, evidently, have been conducted in a most careful and skilful manner, aided by mechanical appliances, evincing much knowledge and ingenuity on the part of the author. One of the most important results of the examination in the intimate structure of the liver is the discovery of two independent capillary nets in the lobules. One of these nets, the familiar vascular arrangement, which might be called for distinction the hæmal capillary net, as is well known, commences at the periphery of the lobules in the termination of the portal vein and hepatic artery, and ends in the central hepatic vein of the interior of the lobules. The other net, the biliary capillary net, consists of delicate tubes, intercalated with the hæmal capillary net, and ends in the interval of the lobules, in the commencement of the hepatic ducts. The hepatic cells occupy the meshes of the two intralobular nets, and exude their material as bile into the biliary capillary net. This view, we may say, confirms that of the most competent observers during the last decade. Better, we may say the researches of such observers, among whom may be mentioned Budge, Hyrtl, Frey, Chrzonszczewsky, Hering, etc., confirm the statement of Dr. Schmidt, for the writer attests to the discovery of the latter a dozen years ago, of the result above mentioned, and noticed in the number of this Journal for January, 1859.